

What is claimed is:

1. A data learning apparatus comprising:

first learning means for deriving a temporary  
self-organizing map in which classes are associated with  
5 respective vector points of reference feature vectors  
by learning first learning data including a plurality  
of first sample feature vectors for each of which a  
corresponding class is known; and

second learning means for modifying the temporary  
10 self-organizing map and deriving a final self-organizing  
map by learning second learning data including a  
plurality of second sample feature vectors for each of  
which a corresponding class is known;

wherein the second learning means includes:

15 second vector specifying means for reading one of  
the second sample feature vectors out of the second  
learning data and specifying a second learning winner  
vector on the temporary self-organizing map which has  
the highest similarity to said one of the second sample  
20 feature vectors;

modification means for comparing a class associated  
with a vector point of the second learning winner vector  
to a corresponding class of said one of the second sample  
feature vectors indicated by the second learning data  
25 and, when the class associated with the vector point of  
the second learning winner vector is not identical to the

corresponding class indicated by the second learning data,  
modifying the second learning winner vector and a  
plurality of reference feature vectors distributed in  
a second learning vicinity of the second learning winner  
5 vector on the temporary self-organizing map so as to  
reduce the similarity thereof to said one of the second  
sample feature vectors; and

means for deriving the final self-organizing map  
by operating each of the second vector specifying means  
10 and the modification means once or repeatedly more than  
once for each of said plurality of second sample feature  
vectors.

2. The data learning apparatus according to claim  
1, wherein the modification means further modifies the  
15 second learning winner vector and said plurality of  
reference feature vectors distributed in the second  
learning vicinity so as to increase the similarity  
thereof to said one of the second sample feature vectors,  
when the class associated with the vector point of the  
20 second learning winner vector is identical to the  
corresponding class of said one of the second sample  
feature vectors indicated by the second learning data.

3. The data learning apparatus according to claim  
1, wherein the first learning means includes:  
25 means for generating an initial self-organizing map  
on which a plurality of random reference feature vectors

are distributed;

means for generating a plurality of frequency maps,  
in which initial values of specified frequency values  
allocated to respective points are zero, each of the  
5 frequency maps corresponding to one class;

first vector specifying means for reading one of  
first sample feature vectors out of the first learning  
data and specifying a first learning winner vector on  
the initial self-organizing map which has the highest  
10 similarity to said one of the first sample feature  
vectors;

update means for modifying the first learning  
winner vector and a plurality of reference feature  
vectors distributed in a first learning vicinity of the  
15 first learning winner vector on the initial  
self-organizing map so as to increase the similarity  
thereof to said one of the first sample feature vectors,  
and for increasing the specified frequency values in  
points corresponding to respective vector points of the  
20 first learning winner vector and said plurality of  
reference feature vectors distributed in the first  
learning vicinity on a frequency map corresponding to  
a corresponding class of said one of the first sample  
feature vectors indicated by the first learning data;

25 means for deriving the temporary self-organizing  
map by operating each of the first vector specifying means

and the update means once or repeatedly more than once for each of said plurality of first sample feature vectors; and

means for defining a class which is most likely to  
5 appear at each vector point on the temporary self-organizing map as the class associated with said vector point by referring to said plurality of frequency maps.

4. The data learning apparatus according to claim  
10 1, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning  
15 data and the second learning data is a class indicating a meaning of an image.

5. A data learning apparatus comprising:

first learning means for deriving a temporary self-organizing map in which classes are associated with  
20 respective vector points of reference feature vectors by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

second learning means for modifying the temporary  
25 self-organizing map and deriving a final self-organizing map by learning second learning data including a

plurality of second sample feature vectors for each of which a corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of  
5 the second sample feature vectors out of the second learning data and specifying a second learning winner vector having the highest similarity to said one of the second sample feature vectors among the reference feature vectors on the temporary self-organizing map of which  
10 the vector points are associated with a class that is identical to a corresponding class of said one of the second sample feature vectors indicated by the second learning data;

modification means for modifying the second  
15 learning winner vector and a plurality of reference feature vectors distributed in a second learning vicinity of the second learning winner vector on the temporary self-organizing map so as to increase the similarity thereof to said one of the second sample feature vectors;

20 and

means for deriving the final self-organizing map by operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature  
25 vectors.

6. The data learning apparatus according to claim

5, wherein the first learning means includes:

means for generating an initial self-organizing map on which a plurality of random reference feature vectors are distributed;

5 means for generating a plurality of frequency maps, in which initial values of specified frequency values allocated to respective points are zero, each of the frequency maps corresponding to one class;

first vector specifying means for reading one of  
10 first sample feature vectors out of the first learning data and specifying a first learning winner vector on the initial self-organizing map which has the highest similarity to said one of the first sample feature vectors;

15 update means for modifying the first learning winner vector and a plurality of reference feature vectors distributed in a first learning vicinity of the first learning winner vector on the initial self-organizing map so as to increase the similarity  
20 thereof to said one of the first sample feature vectors, and for increasing the specified frequency values in points corresponding to respective vector points of the first learning winner vector and said plurality of reference feature vectors distributed in the first  
25 learning vicinity on a frequency map corresponding to a corresponding class of said one of the first sample

feature vectors indicated by the first learning data;

means for deriving the temporary self-organizing map by operating each of the first vector specifying means and the update means once or repeatedly more than once  
5 for each of said plurality of first sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the temporary self-organizing map as the class associated with said  
10 vector point by referring to said plurality of frequency maps.

7. The data learning apparatus according to claim 5, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature  
15 vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

20 8. A data learning apparatus comprising:

first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors  
25 for each of which a corresponding class is known; and  
second learning means for modifying said plurality

of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a  
5 corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner  
10 vector on the self-organizing map which has the highest similarity to said one of the second sample feature vectors;

modification means for performing modification of increasing a specified frequency value of a corresponding  
15 point corresponding to a vector point of the second learning winner vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on a frequency map corresponding to a correct class which is the same as a corresponding class  
20 of said one of the second sample feature vectors indicated by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or  
25 repeatedly more than once for each of said plurality of second sample feature vectors; and



means for defining a class which is most likely to appear at each vector point on the self-organizing map as a final class associated with said vector point by referring to said plurality of frequency maps.

5           9. The data learning apparatus according to claim 8, wherein the modification means performs the modification only in either one of cases where a class associated with a frequency map showing the highest specified frequency value at a point corresponding to  
10 a vector point of the second learning winner vector specified by a preceding operation of the second vector specifying means and a corresponding class of said one of the second sample feature vectors indicated by the second learning data are identical and are not identical  
15 to each other.

10. The data learning apparatus according to claim 8, wherein the first learning means includes:

means for generating an initial self-organizing map on which a plurality of random reference feature vectors  
20 are distributed;

means for generating a plurality of frequency maps, in which initial values of specified frequency values allocated to respective points are zero, each of the frequency maps corresponding to one class;

25           first vector specifying means for reading one of first sample feature vectors out of the first learning

data and specifying a first learning winner vector on the initial self-organizing map which has the highest similarity to said one of the first sample feature vectors;

5        update means for modifying the first learning winner vector and a plurality of reference feature vectors distributed in a vicinity of the first learning winner vector on the initial self-organizing map so as to increase the similarity thereof to said one of the  
10 first sample feature vectors, and for increasing the specified frequency values in points corresponding to respective vector points of the first learning winner vector and said plurality of reference feature vectors distributed in the vicinity on a frequency map  
15 corresponding to a corresponding class of said one of the first sample feature vectors indicated by the first learning data; and

      means for operating each of the first vector specifying means and the update means once or repeatedly  
20 more than once for each of said plurality of first sample feature vectors.

11. The data learning apparatus according to claim 8, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature  
25 vectors is a vector having feature quantities indicating features of an image as components thereof, and each of

the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

12. A data learning apparatus comprising:

5 first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and  
10 second learning means for modifying said plurality of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a  
15 corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner  
20 vector on the self-organizing map which has the highest similarity to said one of the second sample feature vectors;

modification means for performing modification of decreasing a specified frequency value of a corresponding  
25 point corresponding to a vector point of the second learning winner vector or specified frequency values of

said corresponding point and points distributed in a vicinity thereof on some of or all of the frequency maps except for a frequency map corresponding to a correct class which is the same as a corresponding class of said one of the second sample feature vectors indicated by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the self-organizing map to a final class associated with said vector point by referring to said plurality of frequency maps.

13. The data learning apparatus according to claim 12, wherein the modification means further performs modification of increasing a specified frequency value of a corresponding point corresponding to a vector point of the second learning winner vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on a frequency map corresponding to said correct class.

14. The data learning apparatus according to claim 12, wherein the modification means performs the modification only in either one of cases where a class

associated with a frequency map showing the highest specified frequency value at a point corresponding to a vector point of the second learning winner vector specified by a preceding operation of the second vector specifying means and a corresponding class of said one of the second sample feature vectors indicated by the second learning data are identical and are not identical to each other.

15 12, wherein the first learning means includes:

means for generating an initial self-organizing map on which a plurality of random reference feature vectors are distributed;

15 means for generating a plurality of frequency maps, in which initial values of specified frequency values allocated to respective points are zero, each of the frequency maps corresponding to one class;

20 first vector specifying means for reading one of first sample feature vectors out of the first learning data and specifying a first learning winner vector on the initial self-organizing map which has the highest similarity to said one of the first sample feature vectors;

25 update means for modifying the first learning winner vector and a plurality of reference feature vectors distributed in a vicinity of the first learning

winner vector on the initial self-organizing map so as to increase the similarity thereof to said one of the first sample feature vectors, and for increasing the specified frequency values in points corresponding to  
5 respective vector points of the first learning winner vector and said plurality of reference feature vectors distributed in the vicinity on a frequency map corresponding to a corresponding class of said one of the first sample feature vectors indicated by the first  
10 learning data; and

means for operating each of the first vector specifying means and the update means once or repeatedly more than once for each of said plurality of first sample feature vectors.

15 16. The data learning apparatus according to claim 12, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of  
20 the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

17. A data learning program for making a computer operate as:

25 first learning means for deriving a temporary self-organizing map in which classes are associated with

respective vector points of reference feature vectors by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

5        second learning means for modifying the temporary self-organizing map and deriving a final self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a corresponding class is known;

10       wherein the second learning means includes:

      second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector on the temporary self-organizing map which has  
15    the highest similarity to said one of the second sample feature vectors;

      modification means for comparing a class associated with a vector point of the second learning winner vector to a corresponding class of said one of the second sample  
20    feature vectors indicated by the second learning data and, when the class associated with the vector point of the second learning winner vector is not identical to the corresponding class indicated by the second learning data, modifying the second learning winner vector and a  
25    plurality of reference feature vectors distributed in a second learning vicinity of the second learning winner

vector on the temporary self-organizing map so as to reduce the similarity thereof to said one of the second sample feature vectors; and

means for deriving the final self-organizing map  
5 by operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature vectors.

18. The data learning program according to claim  
10 17, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning  
15 data and the second learning data is a class indicating a meaning of an image.

19. A data learning program for making a computer operate as:

first learning means for deriving a temporary  
20 self-organizing map in which classes are associated with respective vector points of reference feature vectors by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

25 second learning means for modifying the temporary self-organizing map and deriving a final self-organizing



map by learning second learning data including a plurality of second sample feature vectors for each of which a corresponding class is known;

wherein the second learning means includes:

5        second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector having the highest similarity to said one of the second sample feature vectors among the reference feature  
10        vectors on the temporary self-organizing map of which the vector points are associated with a class that is identical to a corresponding class of said one of the second sample feature vectors indicated by the second learning data;

15        modification means for modifying the second learning winner vector and a plurality of reference feature vectors distributed in a second learning vicinity of the second learning winner vector on the temporary self-organizing map so as to increase the similarity  
20        thereof to said one of the second sample feature vectors;  
and

means for deriving the final self-organizing map by operating each of the second vector specifying means and the modification means once or repeatedly more than  
25        once for each of said plurality of second sample feature vectors.

20. The data learning program according to claim 19, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

21. A data learning program for making a computer operate as:

first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

second learning means for modifying said plurality of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector on the self-organizing map which has the highest

similarity to said one of the second sample feature vectors;

modification means for performing modification of increasing a specified frequency value of a corresponding point corresponding to a vector point of the second learning winner vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on a frequency map corresponding to a correct class which is the same as a corresponding class of said one of the second sample feature vectors indicated by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the self-organizing map as a final class associated with said vector point by referring to said plurality of frequency maps.

22. The data learning program according to claim 21, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning

data and the second learning data is a class indicating a meaning of an image.

23. A data learning program for making a computer operate as:

5 first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and  
10 second learning means for modifying said plurality of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a  
15 corresponding class is known,

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner  
20 vector on the self-organizing map which has the highest similarity to said one of the second sample feature vectors;

modification means for performing modification of decreasing a specified frequency value of a corresponding  
25 point corresponding to a vector point of the second learning winner vector or specified frequency values of

said corresponding point and points distributed in a vicinity thereof on some of or all of the frequency maps except for a frequency map corresponding to a correct class which is the same as a corresponding class of said one of the second sample feature vectors indicated by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the self-organizing map to a final class associated with said vector point by referring to said plurality of frequency maps.

24. The data learning program according to claim 23, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

25. A computer-readable recording medium carrying a data learning program for making a computer operate as:

first learning means for deriving a temporary self-organizing map in which classes are associated with respective vector points of reference feature vectors by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

second learning means for modifying the temporary self-organizing map and deriving a final self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector on the temporary self-organizing map which has the highest similarity to said one of the second sample feature vectors;

modification means for comparing a class associated with a vector point of the second learning winner vector to a corresponding class of said one of the second sample feature vectors indicated by the second learning data and, when the class associated with the vector point of the second learning winner vector is not identical to the corresponding class indicated by the second learning data, modifying the second learning winner vector and a

plurality of reference feature vectors distributed in a second learning vicinity of the second learning winner vector on the temporary self-organizing map so as to reduce the similarity thereof to said one of the second  
5 sample feature vectors; and

means for deriving the final self-organizing map by operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of second sample feature  
10 vectors.

26. The recording medium according to claim 25, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating  
15 features of an image as components thereof, and each of the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

27. A computer-readable recording medium carrying  
20 a data learning program for making a computer operate as:

first learning means for deriving a temporary self-organizing map in which classes are associated with respective vector points of reference feature vectors  
25 by learning first learning data including a plurality of first sample feature vectors for each of which a

corresponding class is known; and

second learning means for modifying the temporary self-organizing map and deriving a final self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of  
5 which a corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner  
10 vector having the highest similarity to said one of the second sample feature vectors among the reference feature vectors on the temporary self-organizing map of which the vector points are associated with a class that is  
15 identical to a corresponding class of said one of the second sample feature vectors indicated by the second learning data;

modification means for modifying the second learning winner vector and a plurality of reference  
20 feature vectors distributed in a second learning vicinity of the second learning winner vector on the temporary self-organizing map so as to increase the similarity thereof to said one of the second sample feature vectors;  
and

25 means for deriving the final self-organizing map by operating each of the second vector specifying means



and the modification means once or repeatedly more than once for each of said plurality of second sample feature vectors.

28. The recording medium according to claim 27,  
5 wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning  
10 data and the second learning data is a class indicating a meaning of an image.

29. A computer-readable recording medium carrying a data learning program for making a computer operate as:

15 first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

20 second learning means for modifying said plurality of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a  
25 corresponding class is known;

wherein the second learning means includes:

second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector on the self-organizing map which has the highest  
5 similarity to said one of the second sample feature vectors;

modification means for performing modification of increasing a specified frequency value of a corresponding point corresponding to a vector point of the second  
10 learning winner vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on a frequency map corresponding to a correct class which is the same as a corresponding class of said one of the second sample feature vectors indicated  
15 by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or repeatedly more than once for each of said plurality of  
20 second sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the self-organizing map as a final class associated with said vector point by referring to said plurality of frequency maps.

25 30. The recording medium according to claim 29, wherein each of said plurality of first sample feature

vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating features of an image as components thereof, and each of the corresponding classes indicated by the first learning data and the second learning data is a class indicating a meaning of an image.

31. A computer-readable recording medium carrying a data learning program for making a computer operate as:

10 first learning means for deriving a self-organizing map and a plurality of frequency maps, each of which corresponds to one class, by learning first learning data including a plurality of first sample feature vectors for each of which a corresponding class is known; and

15 second learning means for modifying said plurality of frequency maps and deciding final classes associated with respective vector points on the self-organizing map by learning second learning data including a plurality of second sample feature vectors for each of which a corresponding class is known,

wherein the second learning means includes:

25 second vector specifying means for reading one of the second sample feature vectors out of the second learning data and specifying a second learning winner vector on the self-organizing map which has the highest similarity to said one of the second sample feature

vectors;

modification means for performing modification of decreasing a specified frequency value of a corresponding point corresponding to a vector point of the second learning winner vector or specified frequency values of  
5 said corresponding point and points distributed in a vicinity thereof on some of or all of the frequency maps except for a frequency map corresponding to a correct class which is the same as a corresponding class of said  
10 one of the second sample feature vectors indicated by the second learning data among said plurality of frequency maps;

means for operating each of the second vector specifying means and the modification means once or  
15 repeatedly more than once for each of said plurality of second sample feature vectors; and

means for defining a class which is most likely to appear at each vector point on the self-organizing map to a final class associated with said vector point by  
20 referring to said plurality of frequency maps.

32. The recording medium according to claim 31, wherein each of said plurality of first sample feature vectors and said plurality of second sample feature vectors is a vector having feature quantities indicating  
25 features of an image as components thereof, and each of the corresponding classes indicated by the first learning

data and the second learning data is a class indicating a meaning of an image.

33. An apparatus for determining meanings of a target image or an image region by use of a self-organizing map obtained after learning, said  
5 self-organizing map having meanings of images associated with respective vector points thereon, comprising:

extraction means for extracting one or a plurality of feature vectors from the target image or the image  
10 region;

winner vector specifying means for specifying a winner vector on the self-organizing map which has the highest similarity to the feature vector for each of said one or plurality of feature vectors;

15 meaning determining means for determining the meaning of the target image or the image region based on meanings associated with respective vector points of the winner vectors;

input means for receiving designation of a target  
20 image or an image region of which a correct meaning cannot have been determined by the meaning determining means, and input of the correct meaning of said target image or said image region; and

modification means for modifying the  
25 self-organizing map by additionally learning the target image or the image region which is designated through

the input means,

wherein, for each of one or a plurality of feature vectors extracted from the designated target image or image region, the modification means modifies a winner  
5 vector having the highest similarity to the feature vector and a plurality of reference feature vectors distributed in a vicinity of the winner vector on the self-organizing map so as to reduce the similarity thereof to said feature vector.

10 34. An apparatus for determining meanings of a target image or an image region by use of a self-organizing map obtained after learning, said self-organizing map having meanings of images associated with respective vector points thereon, comprising:

15 extraction means for extracting one or a plurality of feature vectors from the target image or the image region;

winner vector specifying means for specifying a winner vector on the self-organizing map which has the  
20 highest similarity to the feature vector for each of said one or plurality of feature vectors;

meaning determining means for determining the meaning of the target image or the image region based on meanings associated with respective vector points of  
25 the winner vectors;

input means for receiving designation of a target

image or an image region of which a correct meaning cannot have been determined by the meaning determining means, and input of the correct meaning of said target image or said image region; and

5           modification means for modifying the self-organizing map by additionally learning the target image or the image region which is designated through the input means,

          wherein, for each of one or a plurality of feature  
10 vectors extracted from the designated target image or image region, the modification means re-specifies a winner vector having the highest similarity to the feature vector among reference feature vectors on the self-organizing map of which the vector points are  
15 associated with a meaning that is identical to the correct meaning, and modifies the re-specified winner vector and a plurality of reference feature vectors distributed in a vicinity of the re-specified winner vector on the self-organizing map so as to increase the similarity  
20 thereof to said feature vector.

35. An apparatus for determining meaning of a target image or an image region by use of a self-organizing map obtained after learning and a plurality of frequency maps each of which corresponds  
25 to one meaning of an image, comprising:

          extraction means for extracting one or a plurality

of feature vectors from the target image or the image region;

vector specifying means for specifying a winner vector on the self-organizing map which has the highest  
5 similarity to the feature vector for each of said one or plurality of feature vectors;

meaning determining means for determining the meaning of the target image or the image region based on each meaning associated with a frequency map showing  
10 the highest specified frequency value at a point corresponding to each of vector points of the winner vectors;

input means for receiving designation of a target image or an image region of which a correct meaning cannot  
15 have been determined by the meaning determining means, and input of the correct meaning of said target image or said image region; and

modification means for modifying said plurality of frequency maps by additionally learning the target image  
20 or the image region which is designated through the input means,

wherein, for each of one or a plurality of feature vectors extracted from the designated target image or image region, the modification means increases a  
25 specified frequency value of a corresponding point corresponding to a vector point of a winner vector having



the highest similarity to said feature vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on a frequency map corresponding to the correct meaning.

5           36. An apparatus for determining meaning of a target image or an image region by use of a self-organizing map obtained after learning and a plurality of frequency maps each of which corresponds to one meaning of an image, comprising:

10           extraction means for extracting one or a plurality of feature vectors from the target image or the image region;

            vector specifying means for specifying a winner vector on the self-organizing map which has the highest  
15 similarity to the feature vector for each of said one or plurality of feature vectors;

            meaning determining means for determining the meaning of the target image or the image region based on each meaning associated with a frequency map showing  
20 the highest specified frequency value at a point corresponding to each of vector points of the winner vectors;

            input means for receiving designation of a target image or an image region of which a correct meaning cannot  
25 have been determined by the meaning determining means, and input of the correct meaning of said target image

or said image region; and

modification means for modifying said plurality of frequency maps by additionally learning the target image or the image region which is designated through the input means,

wherein, for each of one or a plurality of feature vectors extracted from the designated target image or image region, the modification means decreases a specified frequency value of a corresponding point corresponding to a vector point of a winner vector having the highest similarity to said feature vector or specified frequency values of said corresponding point and points distributed in a vicinity thereof on some of or all of the frequency maps except for a frequency map corresponding to the correct meaning.